SECTION 675
SANITARY SEWERS

675.1-DESCRIPTION:

This work shall consist of construction or reconstruction of sanitary sewers and appurtenances in accordance with these Specifications and in reasonably close conformity with the lines, grades, dimensions, and locations shown on the Plans or established by the Engineer.

675.2-MATERIALS:

The material shall meet the requirements of the following subsections.

MATERIAL	SUBSECTION
Plastic Pipe (PVC)	718.5
Ductile Iron Pipe	718.1
Cement Lining	718.1.1
Fittings	718.1.2
Mechanical joints	718.1.3
Push-On Joints	718.1.3
Flanged joints	718.1.3
Concrete Brick and Block	715.17
Manholes	605
Manholes, Frames and Grates	605
Structural Concrete	601
Fine Aggregate	718.20
Bedding Material	718.21
Casing Pipe	718.12
Plastic Pipe Fitting	718.8
Controlled Low Strength Material (CLSM)	219

CONSTRUCTION METHODS

675.3-GENERAL:

These Specifications shall apply to the furnishing and installation of all material necessary to complete sanitary sewer relocations and installations in accordance with the Plans.

The Contractor shall furnish all materials, perform all excavation and backfill, construct all necessary joints and connections, construct all appurtenances, install all temporary facilities and dispose of all surplus excavation and discarded material as may be necessary to complete the sanitary sewer relocations and installations.

If the Contractor should observe either proposed or existing sewers or water lines in close proximity the Contractor shall notify the Engineer.

The Engineer will determine if the observed situation lacks conformity to the State Department of Health's Design Standards for Water Distribution Systems, its magnitude and the course of action. Additional costs necessitated by a modification in the plan of construction will be paid for in accordance with 109.4.

The Contractor shall also perform the work of permanently plugging existing sanitary sewers at the locations shown on the Plans or as required due to the field conditions at the time of construction. The plug shall consist of CLSM, type C, or concrete block or brick capped with CLSM, type C, and shall extend a minimum of 1 foot (300 mm) into the existing pipe. The plugging of sanitary sewers, except as provided in 675.16, shall be considered incidental work and its cost shall be included in the unit price bid for sanitary sewer pipe.

The Contractor shall assume all risk and bear any loss or injury to property or persons occasioned by neglect or accident during the progress of the work. The contractor shall make every effort to avoid damaging any existing utility lines or appurtenances.

In the performance of their work, it is of prime importance that the Contractor not disrupt the operation of the existing sanitary sewer facilities in any manner or at any time without the prior written approval of the Engineer. Prior notice shall be given to the Engineer by the Contractor of their intention to begin any work that will disrupt or appreciably alter normal system operation so that the Engineer will have ample opportunity to notify the owner to prepare for any emergency operations that may be required. The Engineer upon advice of the owner will have the sole right of determining at what times and in what order the Contractor shall undertake work involving connections and modifications to the existing system.

The Contractor shall excavate as necessary to determine the number and size of fittings and specials required for connections to existing lines. All material necessary for tie-ins shall be at the work site before discontinuing service. Once the work of connection is begun it shall be continuous until the connection is complete.

675.3.1 - Maintenance of Local Services: The Contractor shall exercise utmost care to avoid damage to trees and hedges, electric, telephone, gas and water lines and other operating sewer lines, buildings, roads and all appurtenances thereto. The interruption of free access to streets, roads and driveways due to trench excavation shall be kept to a minimum. Where possible, a minimum opening of one lane shall be maintained at all times for these appurtenances. All excavated material shall be piled in a manner that will not endanger the work and will not obstruct access to sidewalks and driveways.

Fire hydrants under pressure, valve boxes, service stop boxes, fire and police boxes or other utility controls shall be left unobstructed and accessible. Gutters shall be kept clear or other satisfactory provisions made for drainage. Natural water courses shall not be obstructed. All trenches, material piles, equipment and pipe which may cause a hazard or serve as

obstructions to either vehicular or pedestrian traffic shall be enclosed by fences or barricades, adequately lighted, to protect persons from injury and to avoid property damage. Where traffic must cross open trenches, the Contractor shall provide suitable bridges, which will be subject to approval of the Engineer. The Contractor shall furnish temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstructions encountered in the progress of the work.

675.3.2-Removal of Water: The Contractor shall at all times during construction provide proper and satisfactory means and devices for the removal of all water entering the excavated area, and the Contractor shall remove all such water as fast as it may collect to avoid interference with the prosecution of the work or the proper placing of masonry or other materials.

675.3.3-Hauling and Storing Materials: The Contractor shall be responsible for the unloading, storing, hauling and distribution of all material and shall replace at their expense all such material that is damaged, destroyed or lost. All pipe, pipe fittings and accessories shall be handled so as to avoid shock. Pipe having factory applied joint material shall be stacked and blocked to prevent damage to the joint material. Material not needed for immediate use shall be stored in a safe manner at places provided by the Contractor and approved by the Engineer.

675.4-TRENCH EXCAVATION:

675.4. 1 -General: Excavation of the trench may be done either by hand or by the use of suitable trenching equipment.

675.4.2-Trench Width: The width of the trench shall be ample to permit the pipe to be laid and jointed properly, and to permit the backfill to be placed and compacted as specified. Excessive trench widths will not be permitted. Recommended maximum trench widths at top of pipe are given in Table 675.4.2. Where necessary the trench shall be properly and sufficiently sheeted or braced to prevent caving, slipping or cracking of the sides. Where bracing or sheeting is required or extra width is required for handling of specials, the trench shall be of such extra width to accommodate this work.

TABLE 675.4.2-RECOMMENDED TRENCH WIDTHS AT TOP OF PIPE

Pipe Diameter Inches (mm)	Trench Width Inches (mm)
6 (150)	21 (525)
8 (200)	24 (600)
10 (250)	27 (675)
12 (300)	30 (750)
15 (375)	33 (825)
18 (450)	36 (900)
21 (525)	42 (1 050)
24 (600)	45 (1 125)
27 (675)	48 (1 200)
30 (750)	54 (1 350)
33 (825)	57 (1 425)
36 (900)	60 (1 500)

675.4.3-Blasting: Blasting for excavation will be performed only after securing the approval of the Engineer and only when proper precautions are taken for the protection of persons or property. The Engineer will set the hours of blasting. The Contractor at his expense shall repair any damage caused by blasting.

675.5-BEDDING:

675.5. 1 -General: Bedding of the pipe shall conform to class 'B' as follows:

The trench shall be excavated to a depth that will provide a granular bed of at least 4 inches (100 mm) or the pipe diameter divided by four, whichever is greater, below the pipe in soil. The trench shall then be backfilled with bedding material. The granular bed shall be extended to the spring line of the pipe.

The pipe shall be bedded in suitable material of uniform density. Fine aggregate shall be used to level the foundation.

675.5.2-Unstable Foundation: Where the bottom of the trench at grade is found to be unstable or include ashes, cinders, all types of refuse, vegetable or other organic material, the Contractor shall excavate and remove such unsuitable material to the width and depth ordered by the Engineer. The trench shall be backfilled to the proper grade, in6 inch (150 mm) loose layers, with suitable earth or granular material from unclassified excavation. Each layer shall be thoroughly compacted in accordance with 675.10, and the bedding shall be in accordance with 675.5.1.

675.5.3

There will be no additional compensation for such excavation and backfill, unless the required excavation and replacement exceeds 1 ft. in depth. Excavation and replacement material in excess of 1 ft. in depth will be paid for in accordance with 109.4.

Where the bottom of trench at grade is found to consist of material which is unstable to such a degree that, in the opinion of the Engineer, it cannot be removed and replaced with material suitable to support the pipe properly, the Contractor shall construct a foundation for the pipe, consisting of concrete, pilings or other materials or as directed by the Engineer. A special foundation, if not called for on the Plans, will be paid for in accordance with 109.4.

675.5.3-Rock Foundation: Where rock (or boulders) is encountered, the rock shall be removed to provide a clearance, below and on each side of all pipe, fittings and appurtenances, of at least 6 inches (150 mm) for pipe 24 inches (600 mm) in diameter or smaller and at least 9 inches (225 mm) for pipe larger than 24 inches (600 mm) in diameter. The trench shall be backfilled to invert grade with bedding material in4 in. (100 mm) loose layers. Each layer shall be thoroughly compacted in accordance with 675.10, and the bedding shall be in accordance with 675.5. 1.

675.6-PIPE LAYING:

Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of the work. Line and grade of the pipeline shall be maintained and checked by use of laser beam. For relocation's less than 100 ft (30 m) batter boards, grade line and grade rods or methods of equivalent accuracy may be utilized. Batter boards for gravity sewers shall be set at intervals of not greater than 25 ft. Pipe shall be laid from the lowest point upgrade with the spigot or tongue ends pointing downgrade in the direction of flow.

All pipe, fittings and appurtenances shall be carefully lowered into the trench, piece by piece, by means of a derrick, ropes or other suitable tools or equipment in such a manner as to prevent damage to the sewer line materials, protective coating, and linings. Under no circumstances shall sewer line materials be dropped or dumped into the trench.

All pipe and fittings shall be carefully examined for defects and no pipe or fitting shall be laid which is known to be defective. Any defective, damaged or unsound pipe will be rejected. If any defective piece is discovered after laying, it shall be removed and replaced at the Contractor's expense. All pipes and fittings shall be cleaned before they are laid and shall be kept clean until accepted in the completed work.

The pipe shall be supported its full length by the uniform grade of the trench. Pipe ends shall not be left open at the end of a day's work or during temporary suspension of construction, but shall be securely covered to prevent the entry of foreign matter or animals.

When cutting short lengths of ductile iron pipe, a pipe cutter shall be used and care shall be taken to make the cut at right angles to the centerline

of the pipe. For "push-on" pipe, the cut ends shall be tapered with a portable grinder or coarse file to match the manufactured taper. Plastic pipe may be sawed.

675.7-JOINTING:

Jointing of all pipes is to be preformed in accordance with the manufacturers recommendations.

675.8-CASING PIPE:

Construction methods shall conform to the applicable requirements of the Specification, except that in the event that boring and jacking methods are specified in the Contract or are otherwise necessary to complete the installation, the applicable provisions of 604.11 shall govern.

Damaged coating on the outside of the pipe shall be repaired by hand brushing a thick coat of the same type as the original coating material when placed by open trench construction; outside repair coating is waived for casing pipe to be placed by boring and jacking operations. Inside coating damage shall be repaired, as specified above, for all pipe except as limited by inaccessibility to damage areas for small diameter casing pipe.

675.9-THRUST BLOCKING AND ANCHORAGE:

Thrust blocking or anchorage of sewer force main as shown on the Plans shall be constructed in accordance with 670.4.3 and 670.4.4.

675.10-BACKFILLING:

Backfilling shall be in accordance with 670.4.5

675.11-TESTING INSTALLATIONS:

Exfiltration or air tests shall be made on all sections of new gravity sewer extending from manhole to manhole. New installations that become a part of an existing line and testing is not practical then testing shall not be required. All pressure lines shall be subjected to a pressure test at the pressure shown on the Plans. An infiltration test shall be made only when called for on the Plans. All new manholes shall be tested.

In the event the allowable test rates are exceeded, the Contractor shall determine the location of the leaks and shall repair the sewer or manholes, or both, in a manner satisfactory to the Engineer. The sewer line shall be retested until the leakage in the sewer is within the allowable limits.The Contractor shall include in the unit bid price the cost of all bulkheads, plugs, pipe stoppers, pumps, water, weirs, labor, delay and any other items of cost necessary for the performance and completion of the required tests and for the cost of any repairs or adjustments which may be necessary to make the installations conform to the required allowable leakage rates.

All leakage tests shall be conducted under the observation of the Engineer or representative.

675.11.1-Exfiltration Testing: In conducting the exfiltration test, the line shall be plugged in the lower manhole and filled with water until the water level in the upper manhole is 2 feet (600 mm) above the top of the pipe. The line shall then be left for a period of two hours to allow for absorption of water into pipes and structures, after which it shall be refilled to the specified height and the test begun. Readings shall be taken on the level of the water at one hour intervals, the manhole refilled to an elevation of 2 feet (600 mm) above the top of the pipe and the amount of replacement water recorded. Duration of the test shall be four hours, and the allowable exfiltration shall not exceed that shown in Formula 675.11.1.

Pressure tests for force mains (sewers under pressure) shall be performed in accordance with 670.4.6.

EQUATION 675.11.1-ALLOWABLE LOSS RATE

(Based on Loss Rate of 500 Gal. per Inch Diameter per One Mile per 24 Hours)

{ENGLISH}

Loss = 0.00158 (D)L

Where: Loss = Gallons per Hour

D = Nominal diameter of the pipe in inches

L = Length of pipe in feet

{METRIC}

Loss = 0.000792 (D)L

Where: Loss = Liters per Hour

D = Nominal Diameter in Millimeters

L = Length of pipe in Meters

675.11.2-Infiltration Testing: The infiltration test shall be made by installing a weir or other measuring device approved by the Engineer in the lower end of the sewer section to be tested. The incoming sewer or sewers in the upper end of the test section shall be securely sealed. The quantity of ground water infiltration into the test section shall be measured and shall not exceed that shown in Equation 675.11.1

675.11.3-Low Pressure Air Testing: Low pressure air test conforming to these specifications shall be conducted between consecutive manholes. All Wye branches in the test section shall be plugged. The duration of the test shall be as shown in Table 675.11.3.

The drop in pressure during the prescribed test time shall not exceed 1.0 psi, from 3.5 psi to 2.5 psi testing pressure. A drop below 2.5 psi shall be indication of a failure in the section being tested.

TABLE 675.11.3 – AIR TEST TABLE

Time required for a 1.0 PSI (6.9 kPa) pressure drop.
The required test time shall be the minimum test time or test Duration whichever is greater.

Pipe Diameter inches (mm)	Minimum Test Time Min:Sec	{English} Test Duration L = Feet Sec	{Metric} Test Duration L= Meters Sec
4 (100)	3:46	.380 L	1.246 L
6 (150)	5:40	.854 L	2.802 L
8 (200)	7:34	1.520 L	4.986 L
10 (250)	9:26	2.374 L	7.788 L
12 (300)	11:20	3.418 L	11.21 L
15 (375)	14:10	5.342 L	17.53 L
18 (450)	17:00	7.692 L	25.24 L
21 (525)	19:50	10.470 L	34.35 L
24 (600)	22:40	13.670 L	44.86 L

For sewers 30 inches (750 mm) and greater in diameter, joint testing is an acceptable method of testing. Joint testing shall be accomplished by isolating each joint and applying low pressure air. The line shall be acceptable if each joint passes the air test. The joint will be considered acceptable if the air pressure being applied to the joint drops less than 1 psi (7 kPa) in three minutes. The air pressure applied shall be 4 psi (27.6 kPa) over and above the groundwater back pressure. Groundwater shall be compensated by increasing the 4 psi (27.6 kPa) test pressure by 0.433 psi (9.8 kPa) for each foot (meter) of groundwater. It is the Contractor's responsibility to determine the groundwater level.

675.11.3.1 - Safety Precautions During Air Testing: The pressurizing equipment shall include a regulator set at 10 psi (69 kPa) to avoid over pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manhole during testing.

675.11.4-Manhole Testing: The test shall consist of plugging all inlets and outlets and filling the manhole with water to a height determined by the Engineer. Leakage in each manhole shall not exceed 0.2 gallons per hour per foot (2.48 liters per meter) of head above the invert. A manhole may be filled 24 hours prior to time of testing, if desired, to permit normal absorption into the pipe walls to take place. Repair all manholes that do not meet the leakage test, or are unsatisfactory from visual inspection, to conform to the requirements herein.

The Contractor may request to test manholes for leakage by the vacuum testing procedure developed by Perer A.Glazier and Associates of Worcester, Massachusetts, 01603. This test shall not be used until the

Engineer has given written approval. The Engineer reserves the right to refuse to permit this procedure or to place any condition upon the procedure he deems appropriate.

675.12-RECONSTRUCTED SANITARY SEWER:

Sections of existing sanitary sewers so specified shall be removed and replaced in the same locations. The reconstructed sewer shall be of the type and size as shown on the Plans and shall be laid on a uniform grade between points of removal.

Construction methods shall conform to the applicable requirements of this Specification. Tests shall be performed as set forth in 675.11.

This work shall also include construction and maintenance of temporary lines, as required, to avoid disrupting operation of the existing sanitary sewer system. Temporary service may be maintained by use of pumps and hose lines or in any other manner satisfactory to the Engineer.

675.13-MANHOLE:

Construction of manholes shall conform to the applicable requirements of 605.

675.14-ABANDONING MANHOLES:

Upon completion of the new gravity sewer and placing it in service, or upon abandonment of an existing sewer line, the existing manholes to be abandoned shall be cut down to 2 feet (600 mm) below the proposed finished grade, the inlet and outlet ends of existing pipe plugged with CLSM, Type C, and the manhole backfilled to subgrade elevation with material from the unclassified excavation and compacted.

675.15-ADJUSTING MANHOLES:

Construction methods shall conform to the applicable requirements of Section 605.

675.16-CAPPING MANHOLES:

The existing manhole shall be removed to a minimum depth of 15 ft (450 mm) below the subgrade elevation. Permanent forms of sheet or corrugated sheet steel shall be used to form over the manhole opening. Side forms may be undisturbed earth. No form work shall be placed inside the manhole which will interfere with the flow of the existing sewer. Steel shall be set and the cap poured to Plan dimensions. No finish is required.

675.17 - JUNCTION BOXES:

Construction methods for junction boxes shall conform to the applicable requirements of Section 605.

675.18-METHOD OF MEASUREMENT:

675.18. 1 -Sanitary Sewer Pipe: Pipe of the different types and sizes, both new and reconstructed, will be measured by the linear foot (meter) in place. Measurement will be made along the centerline of each pipe installed. Branch connections, valves, tees, wyes, and elbows will be measured along their centerlines and these lengths included in the total lengths of the appropriate conduit. Wyes, tees, and other branch connections will be measured along the centerlines to points of intersection. Pipe with sloped or skewed ends will be measured along the longitudinal axis through the center of the pipe. The portion of pipe extending through to the inside face of manholes, boxes, or other structures will be included in the measurement.

675.18.2-Manholes: Manholes will be measured as a complete unit in place, including frame, cover and cover castings.

675.18.3-Abandoning Manholes, Adjusting Manholes and Capping Manholes:
"Abandoning Manhole", "Adjusting Manhole", and "Capping Manhole" will be measured as a complete unit in place.

675.18.4-Junction Boxes: "Junction Box" will be measured as a complete unit in place, including, if called for, manhole frame and cover casting (ring type).

675.18.5-Steel Casing Pipe: Steel casing pipe will be measured by the linear foot (meter) complete in place.

675.19-BASIS OF PAYMENT:

The quantities, determined as provided above, will be paid for at the contract unit price bid for the items listed below, which prices and payments shall be full compensation for excavation and bedding, except as otherwise provided. Backfilling, testing, construction and maintenance of temporary service when required, repair and repaving of areas not otherwise provided for in the contract, removal of surplus material and clean-up, furnishing all materials and doing all the work prescribed in a workmanlike and acceptable manner, including all labor, tools, equipment, supplies, and incidentals necessary to complete work.

When boring and jacking of casing pipe is specified in the Contract, the cost of the boring and jacking operations will not be paid for separately but shall be included in the unit price bid for the respective casing pipe pay items. If the Engineer determines that field conditions necessitate the boring and jacking of casing pipe not so specified, the casing pipe pay item as originally specified will be non-performed and the cost for such boring and jacking operations, including the cost of casing pipe, will be paid for in accordance with 109.4

675.20-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
675007-*	“size” PLASTIC SEWER PIPE	LINEAR FOOT (METER)
675008-*	“size” DUCTILE IRON SEWER PIPE, TYPE “type”, CLASS “class”	LINEAR FOOT (METER)
675013-*	“size” RECONSTRUCTED SANITARY SEWER, TYPE “type”	LINEAR FOOT (METER)
675014-*	MANHOLE COMPLETE, INCLUDING CASTING	EACH
675015-*	DROP MANHOLE COMPLETE, INCLUDING CASTING	EACH
675016-*	SPECIAL MANHOLE COMPLETE, INCLUDING CASTING	EACH
675017-*	ABANDONING MANHOLE	EACH
675018-*	ADJUSTING MANHOLE	EACH
675019-*	CAPPING MANHOLE	EACH
675020-*	JUNCTION BOX	EACH
675021-*	“size” STEEL CASING PIPE, THICKNESS “thickness”	LINEAR FOOT (METER)

* Sequence Number

676 through 687: BLANK

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